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Summaries of Addresses of the General President and Presidents of Sections

PRESIDENTIAL ADDRESS

General President: D. N. WADIA, Esq., M.A., B.Sc., F.G.S., F.R.G.S., F.A.S.B.

THE MAKING OF INDIA

THE sub-continent of India consists of two crust-blocks of different nature and constitution, the rigid Archæan shield of Deccan and of the 1,600 miles long folded beds of younger rocks (the Himalayas). Their interaction has produced the third physiographic division of India—the North Indian Plains—built by the alluvial deposits of rivers of the Indo-Gangetic system. These great plains of India cover a trough or depression in front of the earth-waves of the Himalayas passing from Tibet against the immobile crust segment of the Deccan.

The unravelling of the structural features of these three units of earth-body, integrated into one sub-continent, has been India's contribution to the world of science.

In the structure of India, the folded zone has played a comparatively minor part and that also during the last one or two chapters of its history, having but lately emerged from a Central Eurasian sea. This zone bears evidence of great compression whereby the country between Tibet and the Ganges valley has been shortened by 60–80 miles.

The Indo-Gangetic Plain is the newest part to be added to the edifice of India and is still not complete. It has grown almost wholly within the human era by the extension of the flood-plains and deltas of the river systems belonging to the Ganges on the east and to the Indus on the west.

The other structural unit—the Peninsular India—is a non-flexible, obviously impassive block composed of ancient, crystalline rocks which has, since the dawn of Geological history, acted as a peg in the earth's crust. This unit has not attracted so much attention from Geologists as the extrapeninsular region. The old view, that the mountains of Deccan are not true mountains of uplift but are mere relics of an old plateau, is now being gradually given up. Although it is beyond doubt that the segment of India, south of the Aravalli-Hazaribagh line has never been submerged, *en masse*, under the sea since the Cambrian era, or wrinkled into mountain-chains, it bears scars of several periods of earth-movements, though of a kind quite different from the mountain-building movements. Recent geolcgical work carried out by Mr. Wadia in Ceylon has greatly strengthened the new belief. In some respects, the structure of Ceylon furnishes the key to the tectonics of South India.

Ceylon, though an island to-day, is an integral portion of the Carnatic gneissic terrain only recently severed from the mainland, and still connected by Adam's Bridge spanning a shallow strait, only five fathoms deep.

The field Geological work so far carried out in this area indicates, beyond doubt, that the Ceylon mountains are not the undenuded passive remnants left out of an old table land, but have been 'created' by positive earth movements, lifting them vertically in two intermittent, widely separated stages. They are what are known as 'fault mountains' in contrast to the folded, laterally compressed, mountains of the Alps and Himalayan type.

On purely physiographic grounds, Adams made a very suggestive observation in his paper on Geology of Ceylon (1929), that the Deccan plateau represents a continuation of the second peneplain of Ceylon and that the third peneplain of Ceylon might be found in the uplands of the Nilgiris whose highest peaks have approximately the same elevation as the culminating point of Ceylon.

A remarkable parallelism of many of the Ceylon phenomena is detected in the Nilgiri-Palni hills, and their southern extension, the Cardamom hills, which for hundreds of miles have their western, and still more prominently, their south-eastern sides bounded by gigantic precipices. As in the Ceylon mountains, these precipices may not be due to single fractures, but to a system of faults, more or less vertical, in their inclination. They form, in many cases, most striking features of the South Indian landscapes. The Nilgiri-Palni hills and their southern extensions are not the residual stump of an eroded plateau but are upraised mountains with an orographic axis.

The peninsular India has suffered a series of multiple basin-faulting. The severance of Ceylon from India, the straight and steep contour of the Malabar Coast and the easterly drainage of peninsular India can be traced to this multiple basin-faulting. This type of faulting has given to the Deccan a block-mountain and fault-basin structure. The Indian Peninsula, thus, though still a rigid shield, is not an unbroken unit.

The remaining orography of Peninsular India is represented by the tectonic chains of Aravalli and the Eastern Ghats, all but worn away and now existing mainly in their roots. Once of a size comparable with the Himalayas of to-day, these mountain ranges have played a large part in the succession of geological ages and their detrital waste has furnished the raw material of the principal rock systems of India.

The Vindhya and the Satpura chains, which form the main divide of North and South India to-day, are not of as great geological antiquity. There is some evidence that in the early Eocene they were non-existent and that a northerly drainage flowed across their site to Central Deccan. These prominent lines of steep south-facing cliffs, like the cliffs of the Western Ghats in the Konkan, have been produced, by parallel linear faults, now usurped by the valleys of the Narbada and the Tapti. Though of tectonic origin, these ranges have no axis of folding or compression.

A large section of the Deccan possesses the simplest geological structure possible. This section, covering an area of nearly 200,000 square miles, is built up of flat-reposing sheets of lava, forming a pile from 2,000 to 6,000 feet high, completely burying the ancient geography of the land. Time has sculptured this lava plateau into imposing hills, valleys and plains, but these high hills are only the few outstanding portions of the plateau that have withstood weathering, and have no pretensions to be classed as mountains of elevation. They have no orographic axes of folding, but have remained in their original position and attitude. At the time of its completion, this volcanic formation, known as the Deccan trap, must have covered a much wider extent both in area and altitude, and nearly 400,000 cubic miles of molten rock was poured out from the bowels of the earth during this volcanic period —a volume of rock exceeding both in bulk and mass that represented by the entire body of the Himalayas, and of an average density one-tenth higher than that of the Himalayas.

In the making of India the constructive geological processes have only given the broad outlines of the country; the shape or figure of India, as we see it to-day, is determined essentially by the destructive processes of Nature. The sea, rain, rivers and other atmospheric agencies of change, by their ceaseless action have cut deep into the profile of India and have removed thousands of feet of matter from off the surface producing the existing sculpture of the land.

PHYSICS

President: PROF. B. B. RAY

SOME ASPECTS OF X-RAY INVESTIGATIONS ON SOLIDS, ELECTROLYTIC SOLUTIONS, ALLOTROPES AND COLLOIDS

IN the first part of the address Prof. Ray gives a brief review of the electronic theory of metals outlined by Sommerfeld and modified by Periels, Brillouin, Bloch and others, with special reference to soft X-ray 'emission' and 'absorption' edges in solids. This simple theory neglects the lattice structure altogether and treats the valence electron in a metal as a free electron gas. Mott and Jones have modified the theory by taking into consideration the crystalline lattice field. This modified theory is shown to explain satisfactorily the difference in the structures of 'K' and 'L' emission bands of the elements of the first and second groups, which the simple theory fails to account for. However, many important characteristics of the emission and absorption spectra of solids do not find an adequate explanation on the basis of any of the existing theories. The problem is complicated by the uncertainty of the experimental measure of band-widths, caused by the 'tailing effect' of bands, the presence of 'satellites', the overlapping of the absorption and emission edges, and the superposition of the spectra of elements and their oxides formed on the anti-cathode. Further refinement of the experimental method may be expected to throw fresh light on the electronic theory of solids.

The second part of the address deals with the results of investigations carried out by Dr. Ray on the Debye-Scherrer patterns of the allotropes of sulphur, selenium and tellurium, in the crystalline, amorphous, molten and colloidal states. Many of them hitherto known as amorphous are shown to be crystalline. As is to be expected the diffraction photographs show close resemblance in the liquid and amorphous states. The conditions under which the colloidal sols of these elements are crystalline or amorphous are obtained and a mechanism of coagulation is also suggested. The address also deals with secondary absorption spectra of aqueous solutions of iron and cobalt salts of varying concentrations.

CHEMISTRY

President: DR. M. QURESHI

CERTAIN ASPECTS OF PURE AND APPLIED PHOTOCHEMISTRY

AFTER a brief reference to the relative importance of pure and applied research and the great need for a full co-ordination between the two, certain aspects of pure and applied photo-chemistry have been presented.

Strictly speaking the photo-chemist is concerned only with the chemical changes taking place as a result of interaction between matter

and radiation. A proper understanding of the primary act of light absorption and other physical changes connected with this act is however essential for the correct interpretation of the photo-chemical changes that follow. When radiation acts on an atom, an electron may rise to a higher level or may leave the atom producing ionisation. When radiation acts on a molecule, the several possible primary processes are: (*a*) a change in the rotational state, (*b*) changes in the rotational and vibrational states, (c) changes in the electronic, vibrational and rotational states, (*d*) dissociation into atoms immediately on absorption of light, and (*e*) dissociation after a redistribution of the absorbed energy. These primary processes are followed by the secondary processes such as (*a*) fluorescence, (b) dissipation of excitation energy by collisions of the second kind, (*c*) transfer of energy to another molecule, and (*d*) chemical reaction. In the case of simple molecules, it is possible to draw definite conclusions about the nature of the primary processes by a study of the absorption spectra. But with complex molecules, definite conclusions can only be reached by combining photochemical and spectroscopic investigations.

The quantum yield for the primary process of activation or dissociation is obviously unity. But the over-all quantum yield may vary within wide limits on account of secondary effects. Dissipation of energy as heat or occurrence of a reverse reaction can make the over-all quantum yield less than unity; while a chain reaction may lead to values considerably greater than unity.

GEOGRAPHY AND GEODESY

President: MR. GEORGE KURIAN

SOME ASPECTS OF THE REGIONAL GEOGRAPHY OF KERALA

KERALA, the country which lies on the south-western corner of India, cut off from the east coast and the Deccan by the barrier of the Western Ghats, is characterised by a system of backwaters which has exercised considerable influence on the political, commercial, and industrial activities of the country. Beginning with a brief account of the geology of the country, the address proceeds to deal with the climate of this region which is characterised by a striking uniformity of temperature and a fairly abundant rainfall. Then follows an account of the agriculture of the country. The wet lands constitute slightly less than one-third of the total area under occupation, and here rice is practically the only crop cultivated; in the dry and garden lands are grown the perennial crops like coconut, arecanut, jack, mango, cashew-nut, etc., and some root crops like tapioca, yam, and vines like pepper and betel. The question of the density and distribution of the population in Kerala is next considered, and it is shown that a close connection exists between the density of population, the proportion of the cultivable and cultivated lands, and the kind of crops cultivated. Taking note of the rapid rate at which this population is increasing, Mr. Kurian raises the question, "What solution can then be offered for feeding these increasing millions?" A certain amount of industrialisation may "alleviate the suffering, but it may not in itself be able to cure the ailments. Agricultural improvements are certainly called for, and perhaps they are the fundamental sources which are likely to yield results of a more permanent value .... What is actually needed is a new outlook on agricultural enterprise among the governments and the landed aristocracy in the region."

BOTANY

President: N. L. BOR

ECOLOGY: THEORY AND PRACTICE

THE plant geographer has need of a framework of classification of vegetation into which he can fit the facts as he finds them in nature. It is clear that if a system which takes cognisance of ecological concepts be adopted it will be logical and satisfactory. In the past many systems have been formulated which have taken plant form, plant physiology, floristic and so forth as a basis, but none of them have been entirely suitable.

The most modern systems (Clements, Tansley) adopt the dynamic standpoint of the succession of vegetation as their basis. There can be little doubt of the soundness of the basic conception though the conceptions of climax and succession are still in the melting pot. Clements postulates that (1) succession is due to reactions only and is always progressive and (2) that climax is governed by climate alone. This view is adopted by many on logical and philosophical grounds. On the other hand the theory that succession may be forwards, backwards or sideways and that instead of one climax governed by climate there may be several governed by soil, climate or biotic factors, is also accepted by many. Recent discoveries, that podsols are found in low-lying tropical areas and that these bear a vegetation different from that found on adjoining tropical red earths seem to lend some weight to the polyclimax theory.

Whatever may be the ultimate verdict of science upon the theories enunciated above it is clear that the dynamic conception of vegetation is particularly useful when dealing with problems concerning vegetation not yet established, and that, considered as an instrument for the control of the entire range of human uses of vegetation, the conception of succession is unrivalled.

On the other hand the climax is less flexible than the stages of succession. Man can however enrich or impoverish it; it can be destroyed in such a way as to reproduce itself or it can be destroyed so completely as to render its reappearance impossible.

One important fact which emerges from the discussion of climax is that the tropical forest

lives largely upon the products of its own decay. If this be true, and there is little doubt of it, it follows that a luxuriant evergreen forest is no criterion that the soil upon which it is growing is a fertile one. Failure to appreciate this fact has often resulted in forest land being thrown open to cultivation and to its abandonment after a few years when the accumulated fertility due to plant remains alone, had disappeared.

The many problems which arise in India today, due to man's contact with vegetation, such as those connected with forestry, agriculture, grazing, shifting cultivation and so on, must be approached from the ecological angle and dealt with according to the principles of applied ecology.

Erosion, which is causing much concern, at the present time in the Punjab, is due to ascertainable causes and can be prevented by the application of certain principles of plant succession. These and similar problems can be solved by experiment and research based on ecological conceptions.

ZOOLOGY

President: Dr. H. Srinivasa Rao

THE URGENT NEED FOR BIOLOGICAL STATIONS IN INDIA

FIFTEEN out of eighteen universities in India have Biology as a subject for their graduate or post-graduate courses. In the early days the student of Biology in India had to be content with the blackboard and text-book knowledge of this subject. Gradually he has been supplied with preserved specimens and also practical handbooks dealing with Indian types for his study. In recent years good amount of research has been done in India both in Zoology and Botany but mostly confined to the study of structure and classification with the aid of preserved specimens. For nearly seventy years a new complexion has been given to the teaching and research in biological subjects in Europe with the inauguration of Marine and Freshwater Biological Stations. The main purpose of a Biological Station is to provide facilities for the study of animals and plants in their live condition. In India there are no Biological Stations, except the newly started Marine Biological Station of the Travancore State, either on the long stretch of sea coast or on the shores of the numerous vast lakes, although desultory surveys have shown that the wealth of animal and plant life in our rivers, lakes, estuaries, backwaters and seas is infinitely greater than those of temperate climates.

There are immense possibilities of the development of fisheries in India. The bionomics and the life-history of no important Indian fish has yet been worked out, and the European Biologists who are acquainted with Indian conditions rightly attribute the lack of this knowledge to the absence of Biological Stations in India.

The persistence with which the question of establishment of a Marine Biological Station for India has come up during the last ten years before the Indian Science Congress is an indication of the realization by biologists in this country of its importance and urgency. The address pleads for united efforts on the part of biologists, universities, scientific bodies and public men in India to convince the governments concerned of the urgent necessity of establishing Biological stations all over the country and the useful purpose they would serve by promoting knowledge as an instrument of culture and of developing the fisheries with a view to increase the food supply of the country thus giving the masses more nourishment and employment.

ENTOMOLOGY

President: Mr. D. Mukerji

CERTAIN ASPECTS OF MORPHOLOGY OF INSECTS IN RELATION TO HABIT

THE physiological aspect of insect morphology in relation to habit, with special reference to the basic functions of respiration and reproduction, forming the essential subject-matter of the address, is discussed in the case, mainly, of acquatic beetles of the genus Cybister and pulse beetles of the genus Bruchus.

The correlation existing between habit and structure in the larva of Cybister beetle is made clear by a detailed study of the structure of the respiratory mechanism and the natural positions and postures of the larva in the act of feeding and respiring while near the surface of water on submerged weeds, and when below the surface. The special peculiarities in the structure of the lateral and the terminal pairs of abdominal spiracles, are found significant in the light of the functions that devolve on those spiracles. But whether the habit of the larva after it dives under water chasing the prey, to come up to the surface at shorter or longer intervals, is regulated by the oxygen deficiency or excess of carbon-dioxide in the respiratory tubes, must still remain a debatable point. The specialisation in structure and function of the mesothoracic and terminal abdominal spiracle is most marked.

In the larva of the pulse beetle, Bruchus *quadrimaculatus* Fabr. the existence of 4 pair of large ovalshaped air-bladders connected with the tracheal trunks is most peculiar; they evidently store a large quantity of respiratory air and should be regarded as adaptive organs to meet the special requirements of respiration in a closed cavity of the seed, in which the larvæ develop into beetles.

By the study of the peculiar structure of the spiracles of the queen termite (*Termes redemanni* Wasm) and the nature and function of the brownish granular substance ejected through the spiracular apertures, the author makes certain interesting suggestions worthy of consideration.

In the case of the function of reproduction, the relation of structure to habit, has been discussed with reference to the reproductory systems and the genitalia of two species of Bruchus, namely, quadrimaculatus and chinensis. The importance of the structure of the genitalia, in the maintenance of physiological or sexual isolation in insects is pointed out; but in the case of the two species of pulse beetles studied, the structure of the genitalia, does not seem to the author to be an effective bar against the interbreeding of the species. If this should be the case, the question whether hybrids are not present among so-called distinct species of Bruchid beetles infesting our stored products, assumes importance and a genetic analysis of the various species and the examination of their genitalia should be undertaken to decide the question.

ANTHROPOLOGY

President: DR. M. H. KRISHNA

PREHISTORIC DAKHAN

THE address reviews the races of India and proposes a provisional classification based upon recent researches. The history of the various races of India and their immigration to this country is then briefly discussed. The coming of the languages of India in their original form and their sequence is considered. The importance of a study of prehistoric cultures is noted and some of the paleolithic industries of the Dakhan are considered. Then a detailed study is attempted of the light thrown on the prehistory and protohistory of the Dakhan by the excavations at Chandravalli and at Brahmagiri in the Mysore State.

The antiquities of about 2,000 years ago collected at the excavated town of Chandravalli, show that it was the chief city of some local rulers, that it was an industrial town and that it was connected by trade with distant countries including Rome and China.

Brahmagiri in the extreme north of Mysore is a site containing the remains of the town of Isila which was much older than Chandravalli. This site was subjected to trial excavations and revealed the existence of stratified layers reaching back through the prehistoric iron age and the neolithic age to the microlithic age. By a study of the implements and pottery collected from these layers an attempt has been made to prepare a provisional index of the characteristics of antiquities belonging to the various prehistoric and protohistoric periods of the Dakhan, namely the microlithic, the neolithic, the chalcolithic, the iron age, the Mauryan period and the Satavahana period.

Finally the existence of a microlithic period preceding the neolithic is established and the possibility of a short-lived copper age intervening between the neolithic and the iron ages is suggested.

PHYSIOLOGY

President: PROF. B. T. KRISHNAN

THE NEED FOR THE EXPANSION OF PHYSIOLOGICAL AND PHARMACOLOGICAL RESEARCH IN INDIA

THE work carried out so far in the fields of physiology, pharmacology and medicine, in this country, is infinitesimal compared with the vast volume of research work that has been and is being carried out in the Western countries. Ways and means must be devised in various parts of our country for the advancement of medicine in its basic subjects and for turning out greater volume of research work. We are proud of the achievements of our ancestors and the ancient traditions and literature, but we cannot live, progress and compete with the other nations of the world on only traditions and glories of the past. We must progress in scientific thoughts and correlate our ideas of animal physiology with the rapid advances in our knowledge of physics and chemistry and apply the new ideas for the advancement of medicine and pharmacology.

Apart from the general problems in physiology which have an important bearing on the practice of medicine and which still require elucidation by further research, there are several special physiological and allied problems requiring urgent attention and investigation. These are problems of national nutrition, agricultural research, industrial physiology and medicine, physiological standards applicable to India, pharmacological research, with a view to substituting indigenous drugs in place of imported ones and pharmaceutical and biological industry with a view to make the country self-sufficient as regards supply of therapeutic agents, sera, vaccines, etc.

The universities in India should play an important part in the promotion of physiological and pharmacological research. The Government and the universities should afford all facilities for intensive research work in all their institutions teaching chemistry, natural science, physiology, biochemistry, pharmacology, pharmaceutics, bacteriology and medicine by providing well-equipped laboratories and special research assistants and by introducing special diplomas and degrees. Moreover, measures should be adopted for introducing the study of elementary biology, physiology, hygiene and nutrition in the curricula of studies in secondary schools.

MEDICAL AND VETERINARY RESEARCH

President: DR. C. G. PANDIT

IMMUNITY PHENOMENA IN VIRUS DISEASES

DEALING with the present conception of the highly complex problem relating to the mechanism of immunity in virus diseases, a detailed survey of the experimental evidence having a direct bearing on some aspects of this very important phenomena was made.

While the viruses in general exhibited an intimate type of parasitism, adequate knowledge of the vital processes involved when a virus invaded the susceptible cells was lacking. This is also true of other infections. It would appear that the defence mechanism of the infected host is the same whether the infective agent is a bacterium, a virus, or a protozoal organism. Agglutinins, precipitins and neutralizing anti-bodies are produced exactly as in bacterial diseases. If the virus is introduced in the fluids of the host, these anti-bodies are produced and the virus destroyed. The only difference, however, is in the action of the neutralizing anti-body. It is assumed that when the virus is in the body fluids, it unites with the anti-body and becomes susceptible to phagocytosis in much the same way as in bacterial infections. But once the virus enters the susceptible cell, the anti-body has no direct action on the virus. When such a cell divides, the virus will pass into daughter cells and as long as the process is kept up, it will maintain a latent infection or persistence of infection. If the cell is destroyed, the virus will be brought into contact with the anti-body in the surrounding fluid and will then be destroyed. More anti-body is also produced in this way. In case of neurotropic viruses, the virus can also make its way from cell to cell along the connected cytoplasmic processes and ultimately reach its central termination. During its sojourn, it will not come into contact with the anti-body at all, thus explaining the failure of specific immune sera in such infections as poliomyelitis. To this knowledge of the mechanism of immunity following infection, reference is made to Jungeblut's recent hypothesis drawing attention to another defence mechanism which is dependent on environmental factors such as heredity, sex, locality, etc.

Discussing the methods of application of the knowledge so gained in the prevention of virus diseases in man, attention is drawn to the relative merits and demerits, following the use of heat killed vaccines, formalinized vaccines, serum inactivated virus vaccines and attenuated vaccines in the prophylaxis of several diseases.

P. M. N.

AGRICULTURE

President: DR. NAZIR AHMED

SOME TEXTILE FIBRES OF INDIA

THE textile fibres dealt with in the address are only the three fibres, *viz.*, cotton, jute and coir. As may be expected from the kind of work in which Dr. Nazir Ahmed has specialised, cotton occupies the first place and takes up the bulk of the address. As far as we are aware the various fibres of India have never received in any comprehensive manner any critical attention at the hands of the Presidents of the Indian Science Congress and for this reason we should much have desired that the other fibres too had been dealt with. Dr. Ahmed has, moreover, made a slight departure from usual practice by devoting considerable attention to the industrial and commercial aspects of these fibres as they may affect the production and profits of the cultivation as well as the larger and more far-reaching industrial possibilities and the general prosperity of the country. We welcome this special feature. In regard to cotton a general survey is made of the different problems in the cultivation of cotton which have been studied in the different provinces and the success achieved therein. An intensification of the efforts to popularise the results of all this work, generally with a larger measure of financial help from the Provinces and along well recognised methods of extension work, is called for and a strong plea is put in therefor. Though cultivation methods, irrigation, manuring, the baffling diseases, physiological and other conditions leading to crop failures, cotton wilt, boll and leaf-shedding, insect pests like the stem borers and boll weevils have all received attention, the bulk of the work everywhere has of course related to the introduction or evolving of superior varieties or strains, especially of those with longer or better staple. The Panjaub-American cottons, Sind Sea Islands, the Madras Cambodias, the improved Verums of the C.P., the Jubilee of the Panjaub, the Jayavant of Dharwar and other improved cottons are all touched upon in this connection. The disappointing fact that a high yield per acre does not go hand-in-hand with an improvement in staple length is referred to. We would rather stress this point as it is now claimed that judged by the money return per acre, the older strains score over the improved introductions. Dr. Ahmed calculates that in normal years India has to import about half a million bales of long staple cotton, but this cannot be produced locally unless it is made profitable to grow it. Further research alone can solve the problem. India on the other hand suffers from a big surplus of short staple cotton. Measures to expand Indian consumption of Indian mill-goods, a study for stimulating markets for Indian goods abroad, and the diverting of part of the output to other industrial purposes, of which a long list is given, are the remedies suggested.

In regard to jute, reference is made to the higher yielding varieties already made available and the need for research in retting methods, on the ultimate fibre characters of jute, for experiments in the spinning of finer counts of the yarn and the manufacture of the finer kinds of goods, so as to widen the uses to which jute can be put, is emphasised. The bleaching and softening and dying of the jute fibre, adapting it for waterproofing and rot-proofing are also desirable lines of research work.

In regard to coir, the lack of uniformity in the material as prepared now is pointed out and further work on the various aspects of retting is suggested. Work likewise is desirable especially with a view to improve the colour and quality of the fibre and to reduce the period of time now found necessary for the process. Alternative methods especially for preparing good fibre from the husks of ripe nuts, work on the softening, bleaching and dying as well as on making union fabrics with

other fibres are all indicated as important and promising lines of work. In respect of all the fibres dealt with the manufacturing side is emphasised so as to secure a wider utilisation and a larger market for the products.

A. K. Y.

ENGINEERING

President: DR. ANANT H. PANDYA

EDUCATION FOR THE ENGINEERING INDUSTRY

IN his Presidential Address, Dr. Pandya has laid stress on the great and urgent need for the proper training of skilled personnel, a fundamental and vital aspect of industrial development. In spite of numerous technical institutions in India, he remarks, suitable and sufficient training for industries is scanty.

A few experimental technical schools have been started in Bombay and Hyderabad, as a result of Messrs. Abbott and Wood's report on "Vocational Education in India", published in 1937. Also a polytechnic has been opened at Delhi early in 1941. On the 28th July 1941, an Association of Principals of Technical Institutions (India) was formed with a view to co-ordinate the efforts of all Provincial Governments and private bodies and foster all-round co-operation between educational interests, industry and professional bodies.

The conduct of modern industry demands, as Mr. Abbott observes, "the services of men who have had a broad general education, on which they have built a first-rate scientific education". But for university men trained in scientific method, he points out, there would have been a serious dearth of men qualified to carry on research. In the United States, a number of curricula fairly similar is provided so as to enable students to transfer from one curriculum to another at the end of any term during that period, thus affording a freedom of choice among special fields. Humanistic and social subjects including the arts of expression (spoken and written) form part of an engineer's course and the introduction of these subjects in the syllabuses of our institutions, observes Dr. Pandya, deserves very careful consideration.

Research as an instrument of engineering education has not been fully recognised in India. In Great Britain and the United States, it has been accepted as a tenet that research can be used very effectively in the higher classes. Dr. J. C. Jackson observes that competent engineering is a research occupation. Dr. Pandya observes that in India, insufficiency of staff and financial resources of institutions, lack of co-operation between industry and educational institutions and overcrowding of undergraduate syllabuses hamper research. Institution of post-graduate courses which would include research and advanced professional subjects and permitting senior members of staff to have a certain amount of consulting practice, as in medicine, law and architecture would to some extent remedy this unhealthy defect. In India, recently a Board of Scientific and Industrial Research has been established and if the work is to develop rapidly on wholesome lines it is imperative that the training of research workers should be undertaken in a close co-operation with science and engineering colleges.

Industries and commerce must co-operate with technical educational organisations. Abroad, a noteworthy trend in higher technical education is the provision of co-operative courses between the college and works, enabling students to spend part of their time in college and a part in works. Most of the colleges in India, at present experience great difficulty in arranging even for post-graduate practical training of their students. Without a conscious demand from industry and without a close, regular and full co-operation of industry and commerce, technical education cannot progress. Many firms in Europe and America appoint special officers to supervise the practical training of students and Dr. Pandya suggests that our firms will do well "to extend their co-operation in this direction with immediate benefit to every one concerned".

We are at present on the threshold of a new era of industrial expansion. To enable our industries to develop without avoidable delay, it is imperative to bridge the gulf between industry and education and in the measure we are able to span this barrier, we will achieve that essential high technical efficiency, by the continual technical development of our industrial worker.

C. GOPALAKRISNA.

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